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Thomas W. Adams
Renner, Otto, Boisselle, & Sklar, L.L.P.
19th Floor
1621 Euclid Avenue
Cleveland, OH 44115

EXAMINER	
KIELIN, ERIK J	
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BEFORE THE BOARD OF PATENT APPEALS AND INTERFERENCES

Paper No. 15

Application Number: 10/023,548
Filing Date: December 17, 2001
Appellant(s): HALLIYAL ET AL.

Thomas W. Adams
For Appellant

EXAMINER'S ANSWER

This is in response to the appeal brief filed 19 June 2003.

(1) Real Party in Interest

A statement identifying the real party in interest is contained in the brief.

(2) Related Appeals and Interferences

A statement identifying the related appeals and interferences which will directly affect or be directly affected by or have a bearing on the decision in the pending appeal is contained in the brief.

(3) Status of Claims

The statement of the status of the claims contained in the brief is incorrect. A correct statement of the status of the claims is as follows:

This appeal involves claims 1 and 3-13.

Claims 2-4 and 14-21 are withdrawn from consideration as not directed to the elected species.

Further in this regard, Appellant has alleged,

> "However, in the final Office Action [Paper No. 19], the Examiner, with no explanation or reason, asserted that 'newly submitted claims 14-21 [are] directed to an invention that is independent or distinct from the invention originally claimed'."

Examiner respectfully submits that this statement is in error. Appellant disregards the reason provided by Examiner as provided in the Office Action made final (Paper No. 19), which states,

> "Newly submitted claims 14-21 directed to an invention that is independent or distinct from the invention originally claimed **for the reasons indicated in the action filed 8 July 2002**. Claims 14-16 and 18-21 were drawn to non-elected species, as indicated by Applicant in the response submitted 16 July 2002. Claim 17 was amended to depend from non-elected claim 14, and for this reason is withdrawn from further consideration as being drawn to a non-elected claim."

Accordingly, a reason was expressly given. The claims were newly submitted because they were amended in spite of having been withdrawn from consideration and had received no action on the merits.

Moreover, it was noted in the Notice of Defective Appeal Brief (Paper No. 13),

> "Appellant's brief presents issues B and C relating to non-elected, withdrawn claims 2-4 and 14-21. This issue relates to petitionable subject matter under 37 CFR 1.181 and not to appealable subject matter because the claims were restricted and have not been considered. (See MPEP § 1002 and § 1201 --especially § 1201 regarding petition of restriction requirement and the time required for petition.)"

Accordingly, Appellant was well advised by the Office as to the proper course of action to address the non-elected, non-examined claims.

For this reason Examiner respectfully submits that Appellant's statement in the last sentence in the section entitled "Status of Claims", "The Appendix contains a copy of all claims 1-21, all of which are considered by Appellants to be involved in this appeal" is in error. It is also noted that "all claims 1-21" are not provided in the Appendix. Instead, only the claims under appeal are presented.

(4) Status of Amendments After Final

The appellant's statement of the status of amendments after final rejection contained in the brief is incorrect. Appellant submitted no amendments to the claims, the specification, or the drawings after the Office Action made final. Instead, a Request for Reconsideration (Paper No. 8) was submitted and was entered.

(5) Summary of Invention

The summary of invention contained in the brief is deficient because it fails to address the plurality of means by which the first oxide layer may be formed. The specification at p. 11, lines 1-18, indicates that the first oxide layer may be formed by *in situ* steam generation (ISSG), by dry oxidation, or rapid thermal chemical vapor deposition (RTCVD). Accordingly, the summary presented in the Brief places undue emphasis upon the first oxide layer being formed by *in situ* steam generation (ISSG), while omitting the plurality of different means to form the first oxide layer. The importance of this statement will become apparent in responding to Appellant's arguments.

(6) Issues

The appellant's statement of the issues in the brief is correct.

(7) Grouping of Claims

The appellant's statement in the brief that certain claims do not stand or fall together is not *fully* agreed with because independent claims 14 and 18 are *not* co-extensive in scope with claim 1. Accordingly, Examiner respectfully disagrees, that allowance of claim 1 would make claims 14 and 18 allowable because it is not generic. Claims 14 and 18 are drawn to specified semiconductor devices (i.e. two-EEPROM and floating-gate flash structure, respectively). Claim 1, by contrast, is drawn to **any** semiconductor device. The surfaces which are oxidized in claims 14 and 18 are different and Appellant has argued that there exists a difference between oxidizing a semiconductor substrate surface and oxidizing the silicon surface of an intervening layer on a

semiconductor substrate. While not agreeing with Appellant's characterization of independent claim 1, as presented in the instant Brief, Appellant --themselves-- argue against instant claim 1 being generic, as will be discussed below. Accordingly, by Appellant's own admissions, the allowability of claim 1 would not imply allowability of claims 14 and 18. Moreover, a search and examination has not been conducted for the application of the method to the specified devices of claims 14 and 18, but instead to all semiconductor devices, in general.

(8) Claims Appealed

The copy of the appealed claims contained in the Appendix to the brief is correct.

(9) Prior Art of Record

US 4,918,503 Okuyama 4-1990

Van Zant, Microchip Fabrication, 4th ed. McGraw-Hill: New York, 2000, pp. 172-173, 179-182, 480-487.

(10) Grounds of Rejection

The following ground(s) of rejection are applicable to the appealed claims:

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person

having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

Claims 1, 5-12, and 13 stand rejected under 35 U.S.C. 103(a) as being unpatentable over US 4,918,503 (**Okuyama**) in view of **Van Zant**, Microchip Fabrication, 4th ed. McGraw-Hill: New York, 2000, pp. 172-173, 179-182, 480-487.

Regarding claim 1, **Okuyama** discloses a process for fabrication of a semiconductor device including an ONO structure, comprising forming the ONO structure by:

providing a semiconductor substrate **11** having a silicon surface **45** (Figs. 2A-2C, Figs. 5A-5B; col. 1, line 57; col. 3, line 64);

forming a first oxide layer **14** on the silicon surface using steam oxidation (col. 2, lines 34-39);

depositing a silicon nitride layer **15** about 60-120 Å (6 to 12 nm) thick on the first oxide layer (col. 2, lines 59-62) ; and

forming a top oxide layer **16** of 20-60 Å thick on the silicon nitride layer, wherein the top oxide layer is formed by a steam oxidation of a surface of the silicon nitride layer **204** (col. 2, lines 34-39). (See also col. 4, line1 to col. 6, line 39.)

Okuyama does not indicate the method by which the steam oxidation is performed.

Van Zant teaches that the preferred method of performing steam oxidation for cleanliness and control of the process is by providing a mixture of hydrogen (H_2) and oxygen (O_2), which react in the chamber (i.e. *in situ*) to form water as steam. (See pp. 172-173.)

It would have been obvious for one of ordinary skill in the art, at the time of the invention to use the ISSG method of forming steam for the wet oxidation of **Okuyama** for the beneficial reasons just indicated in **Van Zant**.

Regarding claims 5, 6, and 8, the claims state that the dielectric stack is "carried out in an RTP and RTCVD chamber" (claims 5 and 8) or is "carried out in a single-wafer cluster tool" (claims 6 and 8). These limitations are not considered to have patentable weight because it has been held that to be entitled to weight in method claims, the recited structure limitations therein must affect the method in a manipulative sense, and not amount to the mere claiming of a use of a particular structure. See Ex parte Pfeiffer, 1962, C.D. 408 (1961). In the instant case, the apparatus in which the oxide/nitride/oxide stack is formed in not manipulative of the method.

If it is thought somehow that the structure limitations are manipulative of the invention, then this may be a difference. **Van Zant** teaches the benefits of using RTP, RTP-CVD (pp. 179-181), and cluster tools (pp. 480-481).

Further in regard to claim 5, **Van Zant** teaches that RTP, in general, is beneficial for reducing the thermal budget in the formation of semiconductor devices (p. 180, first sentence). On p. 181, **Van Zant** particularly states that rapid thermal wet (steam) oxidation is known and also states that RTP-LPCVD of silicon nitride is known. It would have been obvious for one of ordinary skill in the art, at the time of the invention to form the dielectric stack (oxide/nitride/oxide) of **Okuyama** in an RTP and RTCVD chamber to take advantage of the beneficial reduction in thermal budget, as taught by **Van Zant**.

Further in regard to claim 6, **Van Zant** teaches that clustering tools for automation of process steps reduces time and improves cleanliness and makes better products (i.e. semiconductor devices). (See p. 481.) **Van Zant** also teaches the benefits of using a single wafer cluster tool on p. 486, indicating that single wafer apparatus provides better uniformity and easier process control for larger wafers than does batch wafer processing. It would have been obvious

to one of ordinary skill in the art at the time of the invention to form the semiconductor device of **Okuyama** in a single-wafer cluster tool to take advantage of easier processing, better uniformity, improved cleanliness, and better products, each as taught by **Van Zant**.

Further in regard claim 8, it would be obvious to one of ordinary skill to provide hydrogen and oxygen to the RTP or single-wafer cluster tool to perform the wet oxidation of **Okuyama** because **Van Zant** teaches that *in-situ* generation of steam is cleaner and better controlled and because cluster tools and/or RTP tools provide better control of processes with reduced thermal budget, as just noted above.

Regarding claim 7, although **Okuyama** does not teach the method by which the nitride layer is deposited, **Van Zant** teaches the RTP-LPCVD of nitride is beneficial for, at least, reducing the thermal budget over non-RTP methods. It would have been obvious for one of ordinary skill in the art, at the time of the invention to deposit the nitride layer of **Okuyama** by RTCVD, as taught by **Van Zant**, to reduce the thermal budget in the fabrication of the semiconductor device.

Regarding claim 9, as noted above, **Okuyama** uses the claimed temperature for the wet oxidation, 950 °C (col. 4, lines 48-54).

Regarding claims 10 and 11, **Okuyama** discloses that the ratio of flow rate ratio of the silicon-containing compound to ammonia is about 1:30 in one embodiment, and that the silicon-containing compound is silane or dichlorosilane (col. 6, lines 6-39). This ratio of flow rates falls within Applicant's claimed range of 1:100 to 1:5. **Okuyama** in view of **Van Zant** fails to indicate the specific flow rate. Given that some flow rate is used and that the thickness of the deposited silicon nitride layer falls exactly within the instantly claimed range, the section of the

flow rates would be a matter of routine optimization to select the flow rates to form equal thicknesses. Although the ranges disclosed in **Okuyama** do not fall exactly within the claimed ranges, these claims are *prima facie* obvious without showing that the claimed ranges achieve unexpected results relative to the prior art range. In re Woodruff, 16 USPQ2d 1935, 1937 (Fed. Cir. 1990). See also In re Huang, 40 USPQ2d 1685, 1688(Fed. Cir. 1996)(claimed ranges of a result effective variable, which do not overlap the prior art ranges, are unpatentable unless they produce a new and unexpected result which is different in kind and not merely in degree from the results of the prior art). See also In re Boesch, 205 USPQ 215 (CCPA) (discovery of optimum value of result effective variable in known process is ordinarily within skill of art) and In re Aller, 105 USPQ 233 (CCPA 1955) (selection of optimum ranges within prior art general conditions is obvious). It would have been obvious for one of ordinary skill in the art, at the time of the invention to choose flow rates for the ammonia and silicon-containing compound which are best for the process of forming the silicon nitride layer, according to precedent. Moreover, the flow rates are a function of the CVD reaction chamber and would be varied from one chamber to the next to optimize the process.

Regarding claims 12 and 13, the thicknesses disclosed in **Okuyama** fall within or overlap the claimed thicknesses for the silicon nitride and top oxide layers, as noted above. The exact ranges are obvious over the applied case law, as just noted.

(11) Response to Argument

In the paragraph bridging pp. 5 to 6 of the Brief, Applicant argues,

> "In summary, Appellants respectfully submit the Examiner failed to state a legally correct *prima facie* case of obviousness. The cited references

> fail to disclose all the limitations of Appellants' claims, and fail to provide any legally cognizable suggestion or motivation for making the modifications which would be necessary to reach Appellants' claimed invention. The Examiner's attempts to show all of the limitations and the asserted motivation are legally incorrect and without proper evidentiary basis."

Examiner respectfully disagrees. Examiner will show that all the limitations are disclosed in the applied art and that the rejection of the claims is both legally correct and with evidentiary basis from the applied art and Appellant's admissions on the record.

Applicant argues,

> "The Examiner failed to identify at least two specifically recited limitations of Appellants' claimed invention in the prior art. The first missing limitation relates to formation of the first oxide layer. Appellants' claims specify that the first oxide layer be formed on the silicon surface of a semiconductor substrate; **i.e[.], the first oxide is formed on the substrate**. Okuyama et al. does not disclose formation of an oxide layer on the substrate. Instead, Okuyama et al. discloses formation of two intermediate layers on the substrate, and thereafter formation of an oxide layer over the second intermediate layers." (Emphasis added.)

Examiner respectfully but emphatically disagrees. It is supremely important to note that (A) Appellant is importing limitations or special definitions into the claims that simply do not exist therein --in other words, the "i.e. ..." phrase; and (B) Appellant is ignoring the express teaching in Okuyama which nonetheless, discloses Appellant's selectively narrowed limitation equating "the first oxide is formed on the silicon surface of a semiconductor substrate" with "the first oxide is formed on the substrate."

With regard to (A) Appellant has no basis, either legal or factual, to arbitrarily limit the clear limitations of the claim with the "i.e. ..." phrase used above. The phrases are simply not equal. In this regard, the courts have held that

(1) claim interpretation must begin with the language of the claim itself (see *Smithkline Diagnostics, Inc. v. Helena Laboratories Corp.*, 859 F.2d 878, 882, 8 USPQ2d 1468, 1472 (Fed. Cir. 1988));

(2) "[c]ourts can neither broaden nor narrow the claims to give the patentee something different than what he has set forth [in the claim]" (see *Autogiro Co. of Am. v. United States*, 384 F.2d 391, 396, 155 USPQ 697, 701 (Ct. Cl. 1967); see also *Continental Paper Bag Co. v. Eastern Paper Bag Co.*, 210 U.S. 405, 419 (1908); see also *Cimiotti Unhairing Co. v. American Fur Ref. Co.*, 198 U.S. 399, 410 (1905);

(3) "resort must be had in the first instance to the words of the claim" and words "will be given their ordinary and accustomed meaning, unless it appears that the inventor used them differently." *Envirotech Corp. v. Al George, Inc.*, 730 F.2d 753, 759, 221 USPQ 473, 477 (Fed. Cir. 1984);

(4) it is "fundamental that claims are to be construed in the light of the specification and both are to be read with a view to ascertaining the invention" *United States v. Adams*, 383 U.S. 39, 49, 148 USPQ 479, 482 (1966);

(5) the general claim construction principle that limitations found only in the specification of a patent or patent application should not be imported or read into a claim must be followed (see *In re Priest*, 582 F.2d 33, 37, 199 USPQ 11, 15 (CCPA 1978));

(6) one must be careful not to confuse impermissible imputing of limitations from the specification into a claim with the proper reference to the specification to determine the meaning of a particular word or phrase recited in a claim (see *E.I. Du Pont de Nemours & Co. v. Phillips Petroleum Co.*, 849 F.2d 1430, 1433, 7 USPQ2d 1129, 1131 (Fed. Cir.), cent. denied, 488 U.S. 986 (1988));

(7) claims will be given their broadest reasonable interpretation consistent with the specification, and limitations appearing in the specification are not to be read into the claims. *In re Enter*, 756 F.2d 852, 858, 225 USPQ 1, 5 (Fed. Cir. 1985); and finally

(8) "[t]he name of the game is the claim." *In re Hiniker Co.*, 150 F.3d 1362, 1369, 47 USPQ2d -523, 1529 (Fed. Cir. 1998).

With this in mind, independent claim 1 states, in pertinent part,

> "providing a **semiconductor** substrate having a **silicon surface**;
> forming a first oxide layer on the **silicon surface**;" (Emphasis added.)

Examiner respectfully submits that it is contrary to the case law above for Appellant to equate the "semiconductor substrate having a silicon surface" to be the "semiconductor substrate

surface." All semiconductors are not silicon. Other semiconductors are Ge, SiGe, InP, GaAs, SiC, and a myriad of other III-V and II-VI compounds. Accordingly, the clear meaning of the words used by Appellant to construct the claim indicate that the material of the substrate --i.e. any semiconductor-- need not be the same material from which the surface is made --i.e. silicon. The claim simply does not possess this limitation. For this reason it is improper for Appellant to argue that intervening layers somehow do not constitute "the silicon surface" of "the semiconductor substrate."

Further in this regard, Appellant's specification has not given special or otherwise limited meaning to the above claim limitations; rather, Appellant directly contradicts such narrow interpretation by admissions of record. Appellant has strenuously argued that claim 1 is generic to the species presented in the instant application (see at least the instant Brief sections entitled "Status of Claims" and "Grouping of the Claims" --especially the last sentence of the latter section). The species are the two-bit EEPROM (as shown in Fig. 1 of the instant application) and the floating-gate flash structure (as shown in Fig. 2), and any semiconductor device (last sentence of the section entitled "Disclosure of Invention" in the specification). Pertinently, the species shown in Appellant's Fig. 2 has intervening layers 42 and 44 between the semiconductor substrate 16 and the silicon surface of layer 44 on which the ONO layer 26 is formed. For Appellant's argument that claim 1 is generic to all species of the invention, to be valid, intervening layers between the substrate and the ONO layer must be included, because Appellant expressly includes a species having an intervening layers (i.e. 42 and 44); otherwise, claim 1 cannot be generic, contradicting Appellant's own argument that it is. Accordingly, it is both improper and contradictory for Appellant to argue, on the one hand, that Okuyama cannot

anticipate the claimed feature of forming the oxide on the silicon surface, because intervening layers exist between the silicon surface and the substrate, while on the other hand, arguing that instant claim 1 is generic to a species having intervening layers 42, 44 between the silicon surface of 44 and the substrate 16, as clearly shown in Appellant's Fig. 2. In short, Appellant's semiconductor substrate 16 having a silicon surface 44 must include intervening layers 42, 44 by Appellant's argument that claim 1 is generic.

Examiner notes with interest, in this regard, that the last sentence of the section entitled "Disclosure of Invention" of the instant application, beginning at p. 3 states,

> "Although described in terms of, and particularly applicable to, MIRRORBIT two-bit EEPROM devices and floating gate FLASH devices, the present invention is broadly applicable to fabrication of **any semiconductor device that includes ONO structures**." (Emphasis added.)

Accordingly, the presence of intervening layers is in no way limiting to the "semiconductor substrate having a silicon surface" since Appellant has argued that claim 1 is generic to any semiconductor device, including those with intervening layers, such as that shown in Appellant's Fig. 2 and that shown in Okuyama.

Finally in this regard, more recently the courts have held that a special definition argued by an applicant cannot be the reason for allowance if the special definition is not supported in the disclosure, in cases where the ordinary meaning of the term in the prior art demonstrates that the claim remains unpatentable for the reasons of record. (See *Cf. Festo Corp. v. Shoketsu Kinzoku Kogyo Kabuchiki Co.*, 62 USPQ2d 1705, 1714 (2002)). In the instant case, Appellant's argument that the semiconductor substrate surface is solely the equivalent of the silicon surface is unsupported by Appellant's disclosure and the ordinary meaning of the terms in the prior art of

Okuyama. Okuyama uses "semiconductor substrate" and "silicon substrate" shown, of course, to have a silicon surface. Accordingly, the ordinary meaning of the terms in the prior art given in the disclosure of Okuyama still read on the claims.

With regard to (B), even if it is assumed that Appellant's improperly narrowed interpretation of the claim is valid, Okuyama still discloses this interpretation of "semiconductor substrate having a silicon surface." First, Okuyama discloses that the substrate is a "semiconductor substrate" having a "major surface" (col. 1, lines 55-58) and that the substrate **11** is P-type silicon (col. 3, line 64). Accordingly, the substrate 11 is "a semiconductor substrate having a silicon surface." While Examiner acknowledges that layers 45 and 46 exist, Okuyama teaches that such layers may be formed by implantation *into the silicon surface* of the silicon substrate as clearly shown in Figs. 5A and 5B, with associated discussion in the paragraph bridging cols. 6 and 7. (See especially col. 6, lines 51-64 discussing implantation.) As per this disclosure, the impurities are merely implanted into the surface of the silicon substrate which is then oxidized. Accordingly, Okuyama expressly discloses that the silicon surface is oxidized. That there happens to be implanted impurities within the silicon surface does not change the fact that it is still a silicon surface. There exists nothing in the instant claims limiting the presence of impurities in the silicon surface. Moreover, Appellant's transistors of Figs. 1 and 2 would not work in the absence of such impurities because no conductive channel 18 could be formed in the absence of said impurities. Accordingly, Appellant's argument is factually flawed, in this regard, for ignoring the express disclosure in Okuyama that reads on the instant limitation -- including the improperly narrowed interpretation now presented by Appellant.

For these reasons, Examiner respectfully submits that Okuyama, in fact, discloses the "first missing limitation" that Appellant alleges is absent in Okuyama because (1) as explained above, Appellant's interpretation of the instantly claimed features is contrary to established precedent on claim interpretation and factually erroneous, and (2) even if Appellant's improperly narrowed interpretation were considered proper, Okuyama still discloses Appellant's narrowed interpretation. All of Appellant's argument presented on pages 6 through 9 are based upon the selectively narrowed interpretation of the claim language and have been addressed.

Appellant begins arguing on page 9, last paragraph,

> "The second missing limitation which the Examiner failed to identify in the cited prior art is the use of ISSG [in situ steam generation] oxidation on both the substrate and the nitride layer. In Okuyama et al. at col. 4, the first oxide layer 14 is not formed by steam oxidation, but is formed by thermal oxidation at 900°C under dry oxygen atmosphere. Okuyama et al. teaches oxidation of a portion of the nitride layer by a heat treatment at 950°C under a steam atmosphere. **While Okuyama et al. mentions oxidations in both oxygen and steam atmospheres at col. 2, lines 35-39**, this disclosure is in a very general discussion, provides no conditions, times or other details. It is little more than an invitation to experiment, which is not the suggestion required for obviousness. Rather, any person of skill in the art would refer to, be taught by and follow the much more specific and detailed disclosure at column 4, not by the general introductory remarks at column 2. Thus, the disclosure at col. 2 of Okuyama et al. would not lead a person to use steam oxidation to form the first oxide layer 14, even if the layer 14 was formed on the substrate 11, which it clearly is not." (Emphasis added.)

The portion in bold points out that Appellant acknowledges that Okuyama discloses that steam oxidation may be used. Examiner notes with interest, however, that Appellant glosses over the complete disclosure of Okuyama in regard to steam oxidation to form the first oxide layer at the specified location of col. 2, lines 35-39. This point is extremely important since Appellant

incorrectly argues that Okuyama is forming the first oxide layer *only* by dry oxidation. Verily, Okuyama states,

> "The **first [14] and second [15]** silicon oxide films may be provided through heat treatments under an atmosphere for oxidation, such as oxygen atmosphere or **steam atmosphere**, and the silicon nitride film [15] may be provided by a chemical vapour deposition (CVD) method." (See col. 2, lines 34-39 for quotation and also Figs. 2A-2C, col. 4, lines 37-54 for additional clarification.)

Okuyama expressly states forming the first oxide layer (e.g. 14) by steam oxidation. Moreover, the discussion is in no manner vague as alleged by Appellant. Rather Okuyama goes into great detail to define the thicknesses of the oxide-nitride-oxide layers and the purpose for which each exists as well as variations for specific requirements for the ONO layer. Additional details of steam oxidation of the nitride layer 15 to form the oxide layer 16 are given at col. 4, lines 48-54.

Appellant continues arguing in this regard at p. 10, last paragraph,

> "Furthermore, since Okuyama et al. specifically teach oxidation at 900°C in oxygen for the oxide layer 14, but specifically teach oxidation at 950°C in steam for the oxide layer 16, a person of skill in the art would expect there is a reason for the different conditions, and would be taught away from using steam for both oxidations. It would be speculative for the Examiner or the Board to posit any reason for this difference, or why one would not follow the specific teachings of the reference. In other words, the reference teaches two different oxidations on the two different materials, and does not teach that these could be changed. The disclosure at col. 2 does not suggest any interchangeability."

Examiner respectfully disagrees that Okuyama is somehow wedded to using only dry oxidation to form the first oxide. Appellant agrees. Appellant --in the previous page of the Brief (p. 9)-- acknowledged the location in Okuyama (col. 2, lines 35-39), wherein *steam* is used to form both the *first* and the second oxide layers. Appellant has provided no evidence or passage in Okuyama suggesting that steam should not be used. Rather Appellant points to an embodiment in

Okuyama, wherein dry oxidation is used. Accordingly, it is improper for Appellant to characterize Okuyama as teaching away from its own express teaching --especially after Appellant has recognized that Okuyama suggests using steam to form the first and second oxide layers.

Further in this regard, Examiner respectfully submits that there exists no evidentiary or factual justification for Appellant to assert that one of ordinary skill would ignore the express teachings of Okuyama. Rather, the argument in the above-excerpted paragraph from Appellant's Brief is merely a conclusory observation as to what one of ordinary skill may or may not do. Moreover, the matter is not of obviousness as alleged by Appellant, but of anticipation, because Okuyama meets the requirement for anticipation by expressly disclosing the use of steam oxidation to form *both* the first and second oxide layers of the oxide-nitride-oxide structure. For this reason, Examiner respectfully submits that Appellant's argument in this regard is without proper factually basis. Okuyama is not limited to a single exemplary embodiment within the other embodiments expressly disclosed therein any more than would be Appellant's specification.

As shown above, the art of Okuyama alone teaches (1) steam oxidizing the silicon surface of the semiconductor substrate to from an first oxide layer --whether by the broadest reasonable interpretation or by Appellant's selectively narrowed limitation-- and (2) using steam to form the first oxide by oxidizing the silicon surface of the substrate and using steam to form the second or top oxide layer by oxidizing the nitride layer. Appellant does not contend that Okuyama fails to disclose using steam to oxidize the nitride layer to form the top or second oxide layer. Rather Appellant only contends that Okuyama does not use steam to form both first and

top oxide layers --albeit in direct contradiction to the teaching in Okuyama which Appellant admittedly recognizes, as Appellant notes in Okuyama at col. 2, lines 35-39. Accordingly, the two features alleged by Appellant to be absent from Okuyama are, in fact, present. Appellant's arguments are based upon improper claim interpretation and ignoring the express teachings in Okuyama without legal or factual basis to ignore said teachings.

As stated in the rejection of the claims, Okuyama only fails to teach the claimed method by which the steam is provided. Appellant's arguments in this regard will be addressed now.

Appellant appears to argue, at p. 10, middle two paragraphs of the Brief, that the term "dryox" in Van Zant is somehow not the equivalent of the term "ISSG" (in situ steam generation). First, Van Zant is not required to use Appellant's terminology. Second, Van Zant explains that "dryox" is,

> "In the dry oxidation system, gaseous oxygen and hydrogen are introduced directly into the oxidation tube. Inside the tube, the two gases mix and, under the influence of the high temperature, form steam. The result is a wet oxidation in steam." (Van Zant, p. 172, last paragraph.)

Similarly, the instant specification characterized ISSG as follows,

> "In one embodiment, the ISSG oxidation of the silicon surface 36 [**--not the semiconductor substrate surface--**] is carried out by placing the wafer in the RTP apparatus and flowing a mixture of oxygen-containing gas and hydrogen-containing gas to the chamber at suitable flow rates and pressures. The temperature of the RTP can be in the range from about 800 °C to 1150 °C." (Instant specification, p. 9, lines 12-17.)

Because Van Zant teaches that the steam is formed *in situ* (i.e. in the oxidation chamber) by reaction of oxygen and hydrogen, Van Zant fully meets Appellant's definition of "*in situ* steam generation (ISSG)." The terminology "dryox" is somewhat of a misnomer, since the oxidation is still a wet oxidation. The term perhaps comes from the fact that the steam is produced by "dry"

means, i.e. the reaction of gaseous hydrogen and oxygen, rather than by heating liquid water to form steam.

Applicant argues at p. 12, last paragraph,

> The Examiner both failed to properly state a *prima facie* case of obviousness, and applied an improper standard of obviousness. To establish a *prima facie* case of obviousness, the burden is on the Examiner to establish facts which substantiate: (1) some suggestion or motivation either in the references themselves or in the knowledge generally available to one of ordinary skill in the art, to modify the reference or to combine reference teachings; (2) a reasonable expectation of success that making they asserted modifications and/or combinations would have led to the claimed invention; and (3) that the prior art references must teach or suggest all the claim limitations. See, N1PEP 706.020)). The teaching or suggestion to make the asserted modification and/or combination and the reasonable expectation of success must both be found in the prior art, and not be based on Appellant's disclosure. See, *In re Vaeck*, 20 USPQ2d 1438 (Fed. Cir. 1991)."

Examiner respectfully disagrees. Regarding (1) to quote from the Office action filed 19 December 2002 (Paper No. 7), as repeated above in the section entitled "Grounds of Rejection" above,

> **"Van Zant** teaches that the preferred method of performing steam oxidation for cleanliness and control of the process is by providing a mixture of hydrogen (H_2) and oxygen (O_2), which react in the chamber (i.e. *in situ*) to form water as steam. (See pp. 172-173.)"
>
> "It would have been obvious for one of ordinary skill in the art, at the time of the invention to use the ISSG method of forming steam for the wet oxidation of **Okuyama** for the beneficial reasons just indicated in **Van Zant**."

Where has Examiner failed to provide suggestion/motivation?

Regarding (2), Okuyama teaches using steam. Van Zant teaches *in situ* steam generation is the preferred method for forming steam specifically for oxidation to form semiconductor devices. Accordingly, success the extremely reasonable since Van Zant --a basic text on

semiconductor device fabrication-- teaches that steam is already used for the purpose of forming semiconductor devices. Again, where has Examiner failed to provide reasonable expectation of success that was not clearly evident form the applied art of record?

Regarding (3), as shown above, the applied art expressly teaches each and every claimed feature --including Appellant's improper, overly narrow interpretation of the claim language. Yet again, where has Examiner failed to provide the location of each and every feature of the claims?

Accordingly, Examiner respectfully submits that Appellant's argument in this regard is not persuasive.

Appellant continues arguing in this regard at p. 13,

> "In the present rejections, the Examiner merely selected particular components from the cited references, ignored other intervening structures and steps, and then concluded that these components can be combined, modified or outright omitted to render Appellants' claims obvious. These are, therefore, improper rejections."
>
> "Most importantly, the Examiner failed to show any proper motivation for making the asserted selections, combinations, modifications and omissions in order to arrive at the combination of features recited in Appellants' claims. The Examiner merely asserted that the selected particular components of the references could be selected, combined, modified or omitted, on an *ad hoc* basis, and has not shown any teaching, suggestion or motivation to make the selections, combinations, modifications or omissions."

Examiner respectfully submits that Appellant's assessments of the rejection are presented without evidence and contradict the facts of record. Examiner ignored no structure. Okuyama clearly reads-on the claimed features interpreted either broadly or by Appellant's improperly narrowed interpretation. Examiner cannot address these arguments in the absence of Appellant pointing out exactly what "asserted selections, combinations, modification, and omissions" exist in the art. In

response, Examiner refers the Board to the references applied in the rejection of the claims, as presented above and respectfully submits that the rejections are proper for reasons of record.

Appellant's arguments regarding *In re Wesley* on p. 14 of the Brief are noted. Examiner did not "pick and choose from any one reference only so much of it as will support a given position," as the rejection of the claims, above, makes clear. Okuyama was modified by Van Zant only because Okuyama was silent to the method by which the steam was provided. Van Zant makes up for this deficiency and provides a greater than reasonable expectation of success, given that Van Zant teaches *in situ* steam generation is already successfully used and is the "preferred general oxidation method" for semiconductor device fabrication. In other words, ISSG is already successfully being used for semiconductor device fabrication.

Appellant's arguments regarding *In re Geiger* beginning on p. 14 are noted. Examiner respectfully disagrees that the facts in *Geiger* are similar to those in the instant case. Examiner respectfully submits that the facts are significantly different. First, there is no *composition* being made in the instant claims; instead, there is a *process* being performed for manufacturing a semiconductor device. Second, there is no optimization of variously available additives, which are then optimized in amount. And third, as Applicant has applied the facts in *Geiger* to the instant case, there are no "variously available steps" with regard to the formation of the first oxide layer. Instead, Okuyama provides two means to form the first and second oxides: "heat treatments under an atmosphere for oxidation, such as oxygen atmosphere (e.g. dry oxidation) or steam atmosphere" (col. 2, lines 35-39). Because Okuyama expressly states using steam to form the first oxide layer, it is not variously available but is, instead, specifically used. That Okuyama describes *an* embodiment wherein dry oxygen is used to form the first oxide layer, does not

contradict the statement to use steam alternatively. Accordingly, there is no modification or motivation in Okuyama to use steam because Okuyama expressly states to use steam to form the *first* oxide layer. For these reason, the facts in *Geiger* are inapplicable to those instantly appealed.

Further in regard to the applicability of *Geiger*, as noted above in the section entitled, "Summary of the Invention" Appellant has indicated variously available means to form the first oxide layer, including ISSG, dry oxidation, and RTCVD. Moreover, the section entitled "Disclosure of the Invention" of the instant specification indicates only that the first oxide layer is "formed" without regard to the means of forming, while the top (or second) oxide layer is specifically formed by ISSG in each embodiment. Accordingly, there appears to be no criticality to the first layer being formed by ISSG. Examiner respectfully submits that it is improper for Appellant to argue that *Geiger* disqualifies the prior art of Okuyama while the instant specification does the very same thing Appellant alleges that the Okuyama reference of does: provide variously available steps to form the first oxide layer of the semiconductor device.

Finally in this regard, Applicant argues on the one hand that Okuyama is limited to using dry oxidation to forming the first oxide layer (Brief, pp. 9-10), while arguing on the other hand that Okuyama provides variously available steps (Brief, p. 15, first paragraph), the variously available steps being the reason the decision in *In re Geiger* is said to be applicable to the facts of the instant case. This is contradictory. It is illogical to argue that Okuyama must be using only dry oxidation while at the same time arguing that Okuyama has somehow provided "various steps" which are "variously available in the prior art." Which side is Appellant arguing? Is there one way to form the first oxide or plural ways?

For all of the above reasons, it is believed that the rejections should be sustained.

Respectfully submitted,

Erik Kielin, PhD
September 3, 2003

Conferees at Appeal Conference held 13 August 2003:

Carl Whitehead, Jr., Supervisory Patent Examiner — Date: 3 Sept 03

OC
Olik Chaudhuri, Supervisory Patent Examiner — Date

Erik Kielin, Primary Patent Examiner — Date: 3 Sept '03

Thomas W. Adams
Renner, Otto, Boisselle, & Sklar, L.L.P.
19th Floor
1621 Euclid Avenue
Cleveland, OH 44115